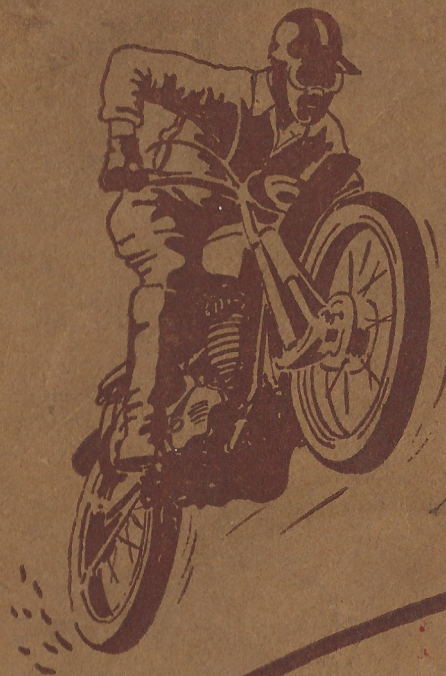


Crane & Son (Printers) Limited
Wolverhampton



Villiers

USERS
HANDBOOK

STAR-MAKER

247 c.c.

SCRAMBLER

TWO-STROKE
ENGINE-GEAR UNIT

THE VILLIERS ENGINEERING COMPANY LTD
WOLVERHAMPTON ENGLAND

FEBRUARY 1963

TWO SHILLINGS

VEC 624

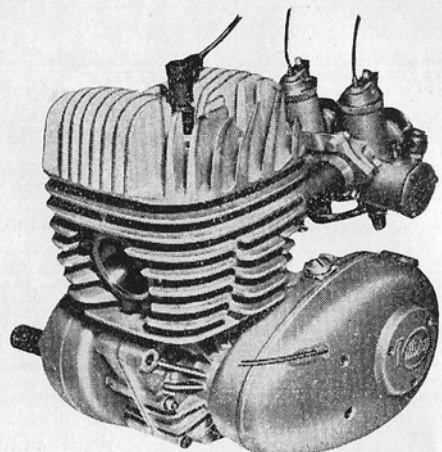
The Peak of Performance . . .

As all scrambles enthusiasts know, an extremely narrow margin separates the winner from the rest of the field. Naturally the owner of a Star-maker engine will expect the best possible performance, but to attain this a great deal will depend upon the maintenance, care and attention to detail given to the engine.

The Star-maker is the result of much thought development and engineering skill, to say nothing of the vast experience which Villiers has accumulated since they began engine manufacture over fifty years ago. However, all this will count for nothing unless the simple but important routine maintenance outlined in the following pages is practised.

Failure to start or finish a race may be caused by one of many simple faults which careful preparation with the assistance of this book will help to avoid.

Always keep this book handy for reference.



TECHNICAL DATA

Bore	68 mm. - 2.676"
Stroke	68 mm. - 2.676"
Swept Volume	247 cc. - 15.07 cu.ins.
Compression Ratio	12:1
Engine Sprocket	20 teeth $\times \frac{3}{8}$ " (9.525 mm.) pitch, .25" (6.35 mm.) roller
Clutch Sprocket	43 teeth $\times \frac{3}{8}$ " (9.525 mm.) pitch, .25" (6.35 mm.) roller
Primary Drive Ratio	2.15
Gear Ratio	1, 1.255, 1.66, 2.53:1
Final Drive Sprocket	15 teeth, $\frac{1}{2}$ " (12.7 mm.) pitch, .335" (8.5 mm.) roller
Carburetters	1 $\frac{1}{8}$ " (28.675 mm.) Amal 389/89 and 389/90
Needle Type	D
Throttle Slide	No. 3
Sparking Plug	Lodge RL.49 or Champion N58R
Sparking Plug Gap	Pre-set (see instructions)
Ignition Timing	19 $\frac{1}{2}$ ° B.T.D.C. ± 1 ° = .085"/.105" (2.159 mm./2.667 mm.)
Contact Breaker Point Gap015" (0.38 mm.)
Lubrication:		
Engine	1 part Castrol "R" to 16 parts petrol
Gearbox	Castrol XL (S.A.E. 30)
Chaincase	Castrol XL (S.A.E. 30)
Cylinder Head Nuts	Torque 160 - 170 inch lbs.

LUBRICATION

ENGINE

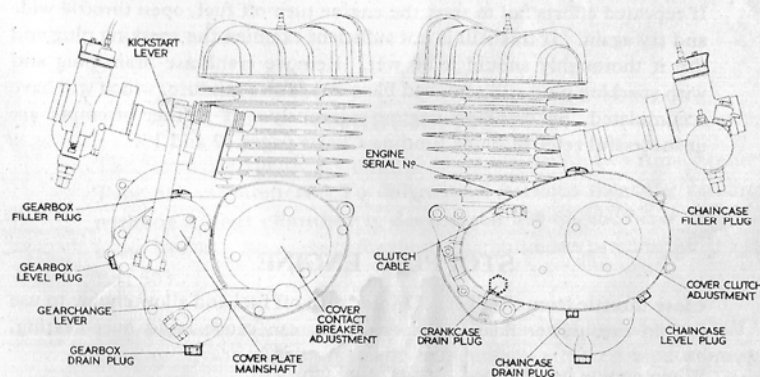
The engine is lubricated by the "petroil" system and no oil other than that introduced with the petrol is necessary, except for gearbox and chaincase. Castrol "R" is recommended in the ratio of 1 in 16, i.e. $\frac{1}{2}$ pint of oil to every gallon of **premium grade petrol** (90-96 octane). It is very important that the fuel and oil are mixed in a separate container and that no other oil is introduced into the mixture. **Castrol "R"** is a castor based lubricant of vegetable extraction and will NOT mix with mineral oil. Castor based oil will remain in suspension in petroleum for a limited period provided it is thoroughly agitated before introducing it into the petrol tank. The time taken for it to separate depends very much on the petrol blend, but is generally from 2 to 3 days. We would, therefore, suggest that the fuel be drained from both the tank and carburetter on completion of the days sport. Failure to do this may cause damage to the engine.

NOTE: The recommended fuel/oil ratio must be adhered to. Too much oil may cause fuel starvation.

GEARBOX

Castrol XL (S.A.E. 30) is recommended for the gearbox. Remove both filler and level plugs and fill gearbox until oil exudes from the level plug orifice. Allow surplus oil to drain off and replace plugs. The illustration shows the location of filler, level and drain plugs.

The level of oil should be checked periodically and the level maintained by refilling as necessary. Oil should be completely drained and renewed every five or six meetings.



CHAINCASE

Castrol XL (S.A.E. 30) is recommended also for the chaincase, and filling instructions are identical as for gearbox. It should be noted, however, that the gearbox and chaincase filler plugs should not be interchanged as the plug for the chaincase has a small breather whilst the gearbox has separate vent pipe and the plug is not drilled for this purpose.

STARTING

When Cold

Turn the petrol on and wait a few seconds for the float chamber to fill, depress the "tickler" and lightly flood the carburetter. Rapid oscillation of the tickler will not help to flood the carburetter any quicker, it is not a pump and if used as one may only cause an eventual puncture in the float.

Place gears in neutral, turn engine over compression, "crack" the throttle open and give the kickstarter a heavy downward kick. The engine should fire, if not try another kick. First time starting is an acquired knack and only with practice can this be acquired.

When Hot

Do not flood carburetter, but repeat operations as above.

Failure to Start

If repeated efforts fail to start the engine turn off fuel, open throttle wide and try again. If this still is not sufficient examine the sparking plug and dry it thoroughly should it be wet. Remove crankcase drain plug and with sparking plug still removed blow out excess mixture, which will have accumulated, by cranking engine vigorously. If further attempts are unsuccessful refer to Fault Finding Charts pages 12 and 13.

STOPPING ENGINE

Close throttle from tickover. **Do not** turn off fuel and allow engine to use fuel in carburetter float chamber as this can cause rapid over-heating.

When engine has stopped turn off fuel tap.

RUNNING IN

The useful life and performance of engine will depend a great deal on the manner in which it is treated during the "running in" period. Running in is a means of "bedding" or settling all the bearing surfaces; a means of wearing down all the minute high spots which exist despite the careful attention to detail and fine finish achieved by modern techniques.

Make full use of the gearbox to keep the loading of engine and gearbox as light as possible. The amount of throttle used initially should not exceed one third of the twist grip's rotation. When any initial tightness disappears from the engine then an increasing amount of work can be permitted. Eventually engine can be run with one throttle fully open and at this point the carburation must be checked in accordance with the instructions given later in this handbook.

Continue the "running in" until three-quarter throttle is used. At this point short periods (2 or 3 minutes) of full throttle may be used and the length of these full throttle periods should gradually be increased until sustained full throttle is used. Gradually introduce the engine to hard working conditions, never allow engine to "labour", have patience and change into a lower gear as quickly and as often as necessary. It is impossible to lay down a time factor, but throughout the period constant alertness for any signs of "distress" and attention to carburation are necessary.

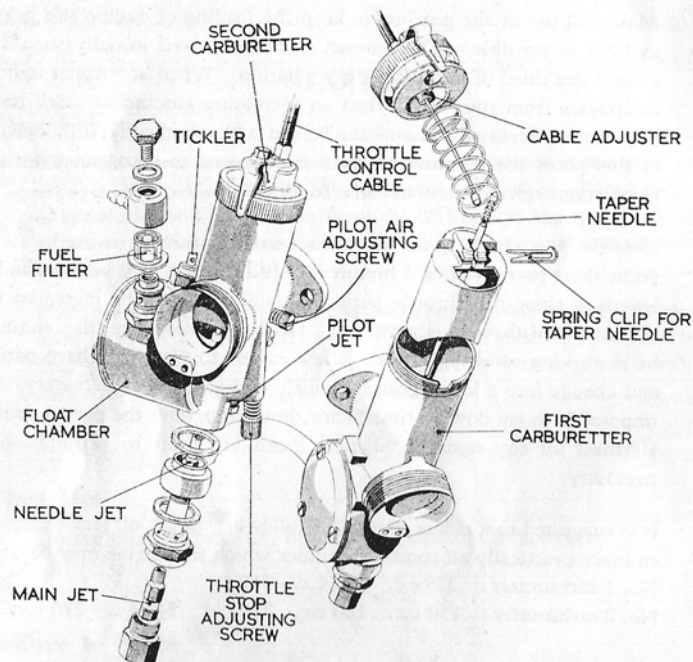
It is suggested that riders carry the following range of jets which will embrace practically all conditions under which the engine may be used :-
No. 1 carburetter: 270 c.c. 290 c.c. 310 c.c.
No. 2 carburetter: 150 c.c. 180 c.c. 210 c.c. 240 c.c. 270 c.c.

CARBURATION

The Starmaker engine is equipped as standard with two Amal Monobloc Type 389 carburetters. To differentiate between them the carburetter **without a float chamber is designated 389 89**, the other carburetter being 389/90. Spare parts for these assemblies are listed in Amal Spares List 503.

Information in this chapter supplements that issued by Messrs. Amal Ltd. in their instructional leaflets and is included with their kind permission.

Cables run from each throttle slide to a control box which is designed to allow a single cable, from the handlebar twist grip, to operate each throttle consecutively; the first opening fully before the second comes into operation.



Standard settings are :

First carburetter — 290 cc. main jet No. 3 slide, needle in highest position.

Second carburetter — 210 cc. main jet No. 3 slide, needle in middle position.

A common float chamber feeds both carburetters via a tube between the two jet blocks.

CARBURETTER TUNING SEQUENCE

Although the two carburetters function as individual units, their combined resultant affects the engine performance once the second throttle starts to open.

To tune the engine accurately it is necessary to know the exact point at which the first throttle is fully open, but the other still completely closed. One method of ensuring this is to disconnect the cable to the second throttle, alternatively, the position can be ascertained by visual inspection of the carburetters. If a marking is made on the twist grip and another on the throttle drum to coincide with this then the position can be seen by the rider during test; this position can actually be felt.

Note that the adjustment on the control box must be set so that there is a minimum of slack in the control cables.

It is suggested that during the running in period a single throttle cable connected from the twist-grip to the first carburetter will not only simplify checking the carburation but will also enable the rider to become familiar with the engine's performance and will avoid the temptation to use full throttle before the engine is fully run in.

Obviously it is best to set the carburation during practice on the day of the race; in fact it is advisable to make a visual check on the mixture strength whenever the machine is used for serious competitive sport. Atmospheric conditions alter from day to day, therefore carburation will need checking if best results are to be obtained.

The following is the method of establishing the correct "jetting":

1. Warm engine thoroughly.
2. Fit a clean racing plug. (either Lodge RL49 or Champion N58R)
3. Motor the machine over a clear (reasonably level) track in top gear with the **first throttle only** fully open for $\frac{1}{2}$ mile (.8 km.) as nearly as possible.
4. "Cut" the throttle and stop engine without allowing it to idle, as this may mask the resultant.
5. Remove sparking plug and examine its condition
Fit larger or smaller main jet as requisite. (Section on Sparking Plugs contains notes on plug reading).
6. Replace the plug, start up and set throttle stop screw so that engine runs steadily, but too fast with twist grip closed. Screw out throttle stop until engine runs slower and begins to falter. Turn air screw in or out until engine runs regularly — i.e. idles satisfactorily and answers to snap openings. Now lower throttle adjusting screw so that when twist grip is full closed engine stops, in order to comply with A.C.U. regulations.

7. Throttle Cut-away and Needle.

It is unlikely that this will need varying from the standard fitting. However, should there be a serious spitting back through the carburetter, turn in pilot air screw to slightly enrich the mixture. If this is not effective readjust the screw and fit a slide with a smaller cut-away. Should engine jerk under load at half to three-quarters throttle opening and there is no spitting either the jet needle is too high or a larger cut-away is required to cure richness.

8. Having completed the settings of the first carburetter refit the racing plug and carry out the main jet check in sections 3, 4 and 5, but this time with the second carburetter connected and twist grip open fully.

As there is no adjustment for the pilot jet on the second carburetter, carry out checks as outlined in section 7 but relevant to the second carburetter.

9. Remember that subsequent to tuning the second carburetter it may prove necessary to carry out further adjustment to the first owing to the hotter running conditions which result with the increase in power when operating with both carburetters.

If any doubt exists of the correctness of settings, a fair indication is that in 2nd gear when pulling "flat out" there should be a slight tendency to alternate between continuous two-stroking and slight four-stroking.

NOTE:

Indiscriminate alteration to exhaust or induction systems must be avoided because special care has been taken in their design. Alteration will adversely affect engine performance.

SPARKING PLUGS

Recommended sparking plugs are Lodge RL.49 or Champion N58R. The point gap is set to the limits $\cdot 012"/\cdot 015"$ ($\cdot 305/\cdot 381$ mm.) at time of manufacture, therefore, it is suggested that if at any time a plug requires setting or cleaning it should be returned to the makers Service Department. If the plug is fouled by oil deposits it can be washed clean in ether, but only provided that oil has not burnt on the insulation of the centre electrode. Any tendency to oiling should be met by fitting a softer grade plug or, conversely, pre-ignition should be studied carefully and if the plug is burnt the carburetter may require adjustment.

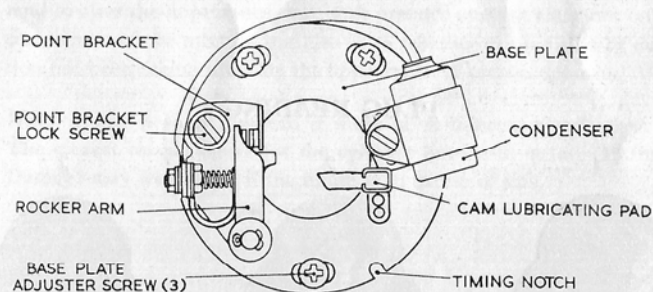
Particularly "twisty" circuits may require softer plugs — RL.47 or similar type. For the running in period and for warming up, use Lodge 2HLN or 3HLN.

IGNITION SYSTEM

The ignition system of the Starmaker engine is of the energy transfer type in which primary current is produced by a flywheel magneto and low tension coils only are housed within the armature plate and right-hand cover, the cover also containing the contact breaker assembly and condenser. The external H.T. coil is encapsulated in special material to prevent damage or "shorting" by water and is mounted in exposed position on the frame of the motor cycle, thus assisting in dispersal of heat.

Access to the contact breaker assembly is via the nameplate secured to the right-hand cover by three screws. The point bracket is secured to base plate by one screw and a dowel, allowing the points to be adjusted to give the specified gap. The base plate is spigotted into the right-hand cover to which it is secured by three screws passing through elongated holes thus allowing rotational movement of the base plate relative to the contact breaker cam and right-hand cover; by this means the ignition timing can be altered. The condenser and felt lubricating pad are secured direct to the base plate.

Ignition Timing



To set the ignition timing rotate engine until contact breaker points are fully open. Release screw securing fixed point bracket and adjust point gap to $\cdot 015"$ ($0\cdot 38$ mm.). Tighten point bracket securing screw. Rotate engine in the normal direction until points just commence to open ($\cdot 0015"$), this is the point where ignition occurs and should be $19\frac{1}{2}^\circ$ before top dead centre, plus or minus 1° measured angularly; measured on the piston this is $\cdot 085"/\cdot 105$ ($2\cdot 16$ mm./ $2\cdot 667$ mm.) before top dead centre. If the correct setting is not obtained slacken the three screws securing base-plate and rotate plate until the dimensions are achieved. Anti-clockwise movement advances, clockwise movement retards, the timing.

CLUTCH AND PRIMARY DRIVE

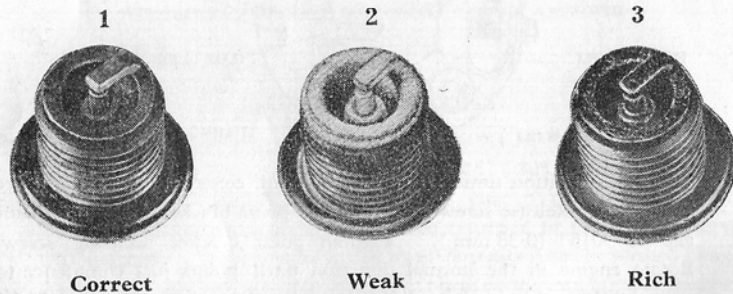
The drive from the engine to the clutch is via a duplex chain lubricated by oil in the primary chaincase; this oil is also utilised to lubricate the clutch support bearing, the clutch itself and the engine drive side needle bearing.

METHOD OF CLUTCH ADJUSTMENT

Remove the small circular cover plate fastened to the outer chaincase by three screws to expose the clutch operating lever and central adjusting screw. To fit clutch cable turn screw clockwise until lever is slack enough to fit replacement cable. Turn screw anti-clockwise until lever having rotated in the opposite direction has approximately three degrees of free movement before operating clutch. Adjust cable so that there is $\frac{1}{16}$ " (1.6 mm.) free movement at handlebar lever before clutch is operated.

Replace cover ensuring joint is fitted accurately.

PLUG READING



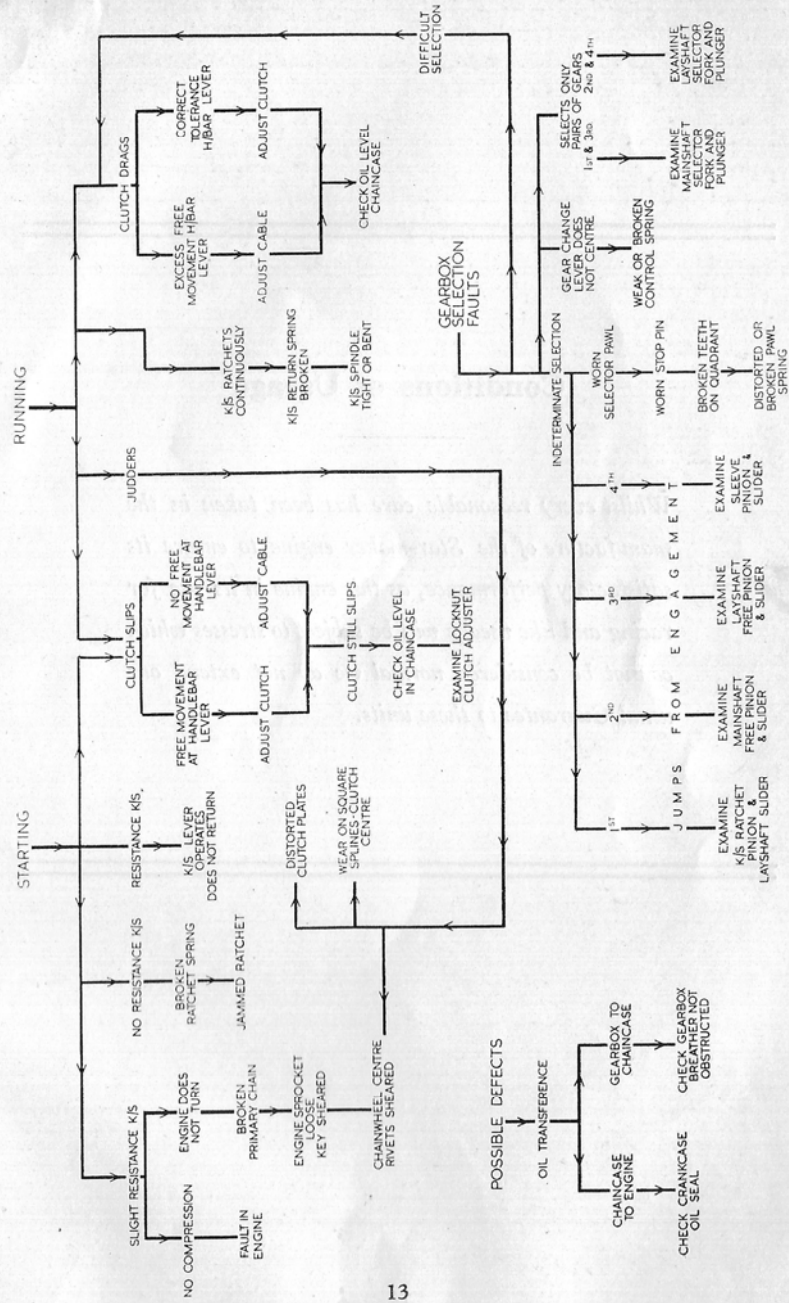
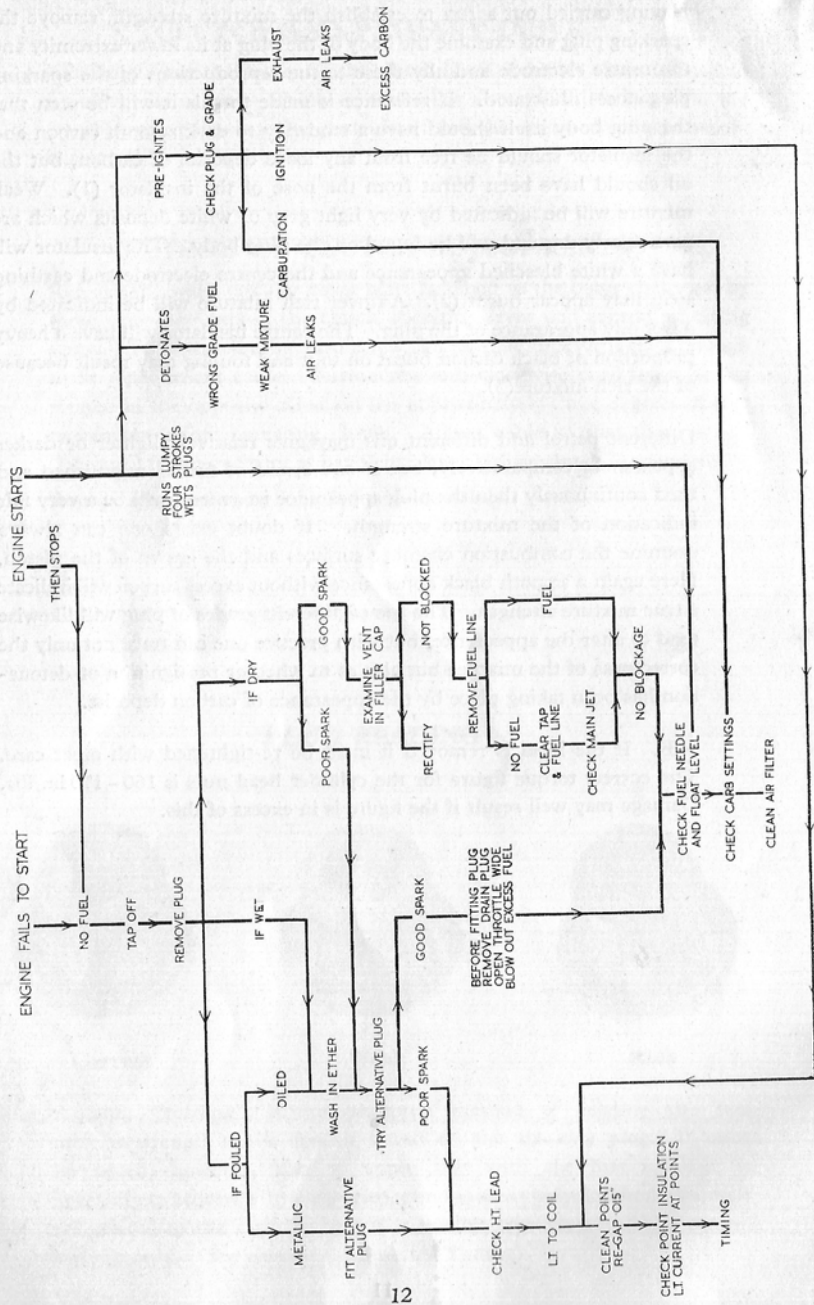
A plug "reading" is one accepted method of relating the fuel mixture strength to the deposit found on the sparking plug. It must be noted, however, that to apply this with the best result it is necessary to acquire a little experience and as all settings for the carburetter are related to the main jet size it is best to take plug readings on full throttle only. (See chapter Carburetter Tuning).

Having carried out a run to establish the mixture strength, remove the sparking plug and examine the body of the plug at its lower extremity and the centre electrode and ally these to the reproductions of the sparking plug noses illustrated. If reference is made to this it will be seen that the plug body itself should have a tendency to dark smooth carbon and the insulator should be free from any loose deposits of carbon, but the oil should have been burnt from the nose of the insulator (1). Weak mixture will be indicated by very light grey or white deposits which are particularly dry and will be found on the plug body. The insulator will have a white bleached appearance and the centre electrode and earthing strip may appear burnt (2). An over rich mixture will be indicated by a wet oily appearance of the plug. The centre insulator will have a heavy proportion of black carbon burnt on to it and fouling may result because of the rich mixture(3).

Different petrol and different oils may give relatively lighter or darker appearances comparatively, but if one brand of fuel is established and used continuously then the plug appearance in general will be a very fair indication of the mixture strength. If doubt exists one can always examine the combustion chamber surfaces and the crown of the piston. Here again a smooth black appearance without excess carbon will indicate a true mixture strength. The use of different grades of plug will likewise tend to alter the appearance, but with practice one can trace not only the correctness of the mixture but also as to whether pre-ignition or detonation has been taking place by the appearance of carbon deposits.

N.B. If the head is removed it must be re-tightened with great care. The correct torque figure for the cylinder head nuts is 160-170 in./lbs. Damage may well result if the figure is in excess of this.

FAULT FINDING CHARTS



Conditions of Useage

Whilst every reasonable care has been taken in the manufacture of the Star-maker engine to ensure its satisfactory performance, as this engine in its use for racing and like useage will be subject to stresses which cannot be considered normal we do not extend our usual Guarantee to these units.

